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ELECTROCHEMISTRY.—*The electrometric titration of zinc with ferrocyanide.* F. RUSSELL v. BICHOWSKY, Geophysical Laboratory. (Communicated by Arthur L. Day.)

The purpose of this note is to point out a set of very interesting polarization phenomena that occur at a platinum electrode when certain insoluble salts, such as zinc, ferric copper, lead, or manganous ferrocyanide, are being precipitated. Only the case of zinc ferrocyanide will be discussed here.

If we place a platinum electrode in a solution of potassium ferrocyanide and titrate this solution with a solution of some zinc salt the e.m.f. of the electrode measured against some standard electrode, such as the normal calomel electrode, follows a perfectly normal curve beginning at about − 0.08 volt (the e.m.f. of the ferrocyanide electrode) and increasing slowly with the addition of the zinc solution until near the end point; on the addition of a drop in excess of the amount of zinc solution necessary to precipitate all the ferrocyanide the e.m.f. increases very sharply to − 0.40 volts. With further excess the e.m.f. stays approximately constant, reaching a maximum value of about − 0.45 volts. The electrometric end point is thus very sharp, and the platinum electrode is by all means the most accurate and convenient device for determining the end point of the zinc ferrocyanide titration.

However, if instead of adding zinc solution to a ferrocyanide solution we reverse the process and add ferrocyanide to the

zinc solution, the initial e.m.f. of the platinum electrode, instead of having the invariant value of − 0.45 volts can be made to have almost any value between 0.0 and − 0.5 volts, depending on the previous treatment of the electrode. If the electrode has been allowed to stand in contact with a ferrocyanide solution for some time the e.m.f. will be between − 0.1 and − 0.25 volts, depending on the length of time it has been in the solution; if it is charged to say − 2.0 volts while in contact with a zinc solution the initial e.m.f. of the electrode may reach the reversible value of − 0.45 volts, or even higher.

If the electrode has been adjusted to an e.m.f. of − 0.45 volts and the titration of zinc with ferrocyanide carried through as before, the exact reverse of the previous curve is obtained, the e.m.f. begins at − 0.45 volts, drops sharply at the end point to − 0.10 and continues at nearly that value on further addition of ferrocyanide. In this case, therefore, our initial curve is reversible. If, however, the platinum electrode has been treated so that it shows an initial voltage of say − 0.20 volts, on adding the ferrocyanide solution the numerical value of the e.m.f. increases slowly, instead of decreasing, this increase continuing until the curve that is obtained by plotting e.m.f. against cc. of ferrocyanide added intercepts the normal curve. At this point the e.m.f. is a maximum. From this point on the e.m.f. curve is entirely normal, the end point being perfectly sharp and unchanged. This phenomenon is similar to the one noted by Forbes and Bartlett[1] for the titration of ferrous iron with dichromate, but in our case not only is it possible to avoid the phenomenon entirely by the proper treatment of the electrode already indicated, but it is also possible not only to control the initial e.m.f. of the electrode, but also the shape and slope of the ascending (abnormal) part of the curve, thus causing the point of interception of the abnormal and normal curve to be varied. In a well stirred solution the abnormal curve starting at − 0.2 volts will almost always intercept the normal curve just before the end point is reached, however, if the stirring is made very

[1] Journ. Amer. Chem. Soc., **35**: 1527. 1913.

poor so that there is any large excess of ferrocyanide in contact with the electrode before the zinc is all precipitated, the end point can be suppressed entirely; or, if by various devices the titration is carried on so that the electrode is always in contact with small concentrations of both zinc and ferrocyanide ion, the point of interception of the normal and abnormal curve can be moved almost to the beginning of the titration, the titration curve thus having a very flat rather than the usual sharp maximum. Of course, in all these cases, except in the case of no stirring, the end point is perfectly sharp and reproducible, and under any of these varied conditions this method of determining the end point is much more rapid, convenient, and accurate than those employing the usual indicators (iron or uranium).

All these phenomena seem to show that in cases of this type depolarization can be accomplished only by some agent (in this case ferrocyanide, in Forbes and Bartlett's case, ferrous iron) whose oxidation and reduction reactions on the platinum electrode are reversible, and that the persistent irreversibility of the Forbes and Bartlett curve and of our curve was due simply to the fact that the only substance in the solution capable of rapid reversible reaction at the electrode was removed from the possibility of acting—by precipitation in our case, and by the excess of an irreversible strong oxidizing agent in Forbes and Bartlett's case. This explanation is independent of any theory of the cause of polarization

MINERALOGY.—*Neodymium as the cause of the red-violet color in certain minerals.*[1] EDGAR T. WHERRY, U. S. National Museum.

Impressed by the intense red-violet color shown by the permanganates, many chemists are inclined to interpret the similar colors occasionally shown by normally colorless minerals, such as calcite and apatite, as due to the presence of manganese. Of course, permanganates may be at once excluded from consideration, for they can only be produced by a somewhat vio-

[1] Published by the permission of the Secretary of the Smithsonian Institution.

lent process—fusing with alkalies and then acidifying—in the course of which the minerals would be destroyed; moreover they are extremely unstable, and even if formed could hardly persist long. Finally, permanganates show a highly characteristic absorption spectrum—observable by placing their solutions between a source of white light and the slit of a spectroscope—consisting of six bands in the yellowish green, green, and greenish blue; but not a trace of this absorption spectrum is shown by any mineral thus far studied.

Certain manganic compounds, containing trivalent manganese, are, however, also red-violet in color, and may develop in minerals under mildly oxidizing conditions. Even colorless bottle-glass, on lying out in the sunlight for a time, becomes red-violet owing to the oxidation of the manganese to that valency.[2] Such manganic compounds show a single rather hazy absorption band in the greenish blue, but only indistinct general absorption of the colors complementary to red-violet.

On the other hand, there is at least one other chemical element, the rare-earth metal neodymium, which has red-violet or violet-red colored compounds; and these yield a highly characteristic absorption spectrum, consisting of an intense band in the orange-yellow, a fainter one in the green, and, if sufficiently concentrated, additional ones in other parts of the spectrum. These bands can readily be seen if a solution of monazite in sulfuric acid is placed between the source of light and the spectroscope slit. They can also be observed in a number of minerals, by the use of the microspectroscope.[3] Of course if the mineral occurs in large enough masses, the ordinary spectroscope may be used, and the mineral be simply placed between the source of light and the slit; those described in this note give good results by this method.

It was pointed out by Headden some years ago[4] that the

[2] See GORTNER, R. A. Journ. Amer. Chem. Soc., **39**: 157–162, 1908.

[3] See the writer's paper, *The microspectroscope in mineralogy*, Smithsonian Misc. Coll., **65**, No. 5, 1915.

[4] Am. J. Sci., [4] **21**: 301, 1906.

red-violet[5] calcite from Joplin, Missouri, gives this neodymium absorption spectrum. This was confirmed by the writer in the paper referred to, and in addition it was noted that the red-violet calcite from Rossie, New York, shows, faintly, the same spectrum. Specimens from Sterlingbush, New York, recently received by the National Museum in exchange from the New York State Museum, have the same color as the latter occurrence, and show the same absorption spectrum.

That manganese is not the cause of the color of these calcites is shown by the following considerations: The calcites contain ferrous iron, and must accordingly have been formed under reducing rather than oxidizing conditions, so that any manganese present must be in the manganous state. Now manganous carbonate, the mineral rhodochrosite, is pure red in color, and that this color is not essentially changed by association of the manganese with calcium is evident from the pale red color of the so-called manganocalcite, such as occurs for instance at Franklin Furnace, New Jersey. Furthermore, many calcites known to contain moderate amounts of manganese show no color whatever. The minute trace of manganese present in these red-violet calcites could therefore not by any possibility produce their color.

There is thus both positive evidence (the absorption spectrum) and negative evidence (the inability of manganese to produce the color) in favor of the view that red-violet calcite in general owes its color to neodymium.

The mineral apatite is sometimes violet in color, but, as recorded in the writer's paper above cited, usually shows no absorption spectrum. Oddly enough the well known brown apatite from Ontario, Canada, yields the absorption bands of neodymium, although any red-violet color that this metal produces is masked; most of the crystals show an underlying green color, due presumably to ferrous iron, the brown being only a sort of local mottling which could readily be produced by irregular distribution of a pale red-violet coloring matter.

[5] An effort was made to name the colors of these calcites according to Ridgway's "Color standards and nomenclature," but accurate comparisons of colors seen only in thick layers of a transparent mineral and those painted on sheets of paper are impracticable. The approximate position of the calcite colors is, however, 67, violet-red, composed of red 52 per cent, violet, 48 per cent.

It would naturally be expected that an occurrence of neodymium-bearing apatite free from the green color of ferrous iron would actually show the red-violet; which expectation has now been fulfilled. The U. S. Geological Survey has recently transmitted to the National Museum an extensive series of minerals collected by Dr. W. T. Schaller in the pegmatites of southern California, among which are two kinds of violet apatite. One, the color of which is pure violet, from the Mountain Lily Mine, Oak Grove, agrees with apatites from Maine and Saxony, previously examined, in color and in absence of absorption spectrum; no guess will here be hazarded as to the cause of its color. But the other, from the San Diego Mine, Mesa Grande, has a red-violet color similar to that of the Joplin calcite, and shows an even more intense absorption spectrum, so is to be regarded as also owing its color to neodymium.

GENETICS.—*A correlation between endosperm color and albinism in maize.* J. H. KEMPTON, Bureau of Plant Industry. (Communicated by G. N. Collins.)

Seedlings in which chlorophyll does not develop occur not infrequently in many cultivated species. Such plants are known as albinos. As photosynthesis is impossible without chlorophyll these seedlings soon perish. Some varieties of maize produce many albino seedlings, and it has been possible to isolate strains which give regularly a certain proportion of albino seedlings. Several investigators have tested the exactness of the ratio between normal and albino plants and have concluded that albinism is a simple Mendelian character, recessive to the normal form.[1]

[1] EAST, E. M., and HAYS, H. K. *Inheritance in maize.* Conn. Agr. Exp. Sta. Bull., clxvii, 1911.

EMERSON, R. A. *The inheritance of certain forms of chlorophyll reduction in corn leaves.* Nebr. Agr. Exp. Sta. Twenty-fifth annual report. 1912.

GERNERT, W. B. *The analysis of characters in corn and their behaviour in transmission.* Published by author, 1912.

MILES, FRANK C. *A genetic and cytological study of certain types of albinism in maize.* Journal of Genetics, 4: 193. 1915.

In studying the effects of temperature and light upon the rate of elongation of albino seedlings the writer had occasion to grow seedlings from an ear which had both yellow and white seeds, and found what appears to be a correlation between the color of the endosperm in the seed and the development of chlorophyll in the seedlings. The ear from which this seed was secured was the result of a self-fertilized first generation plant of a cross between *Zea tunicata* and *Zea ramosa*. This cross has been recently described in detail by Mr. Collins.[2]

The ear was non-podded and had approximately three yellow seeds to one white. The actual figures were 70 yellow and 18 white. These yellow seeds were similar to those reported by other investigators of yellow endosperm in that they varied greatly in the intensity of the color, but in this instance little difficulty was encountered in segregating the white seeds. The 70 yellow seeds were divided into four groups with respect to the intensity of the color, the two darkest groups having 18 seeds each, and the two lightest groups having 17 seeds each.

TABLE 1

	NORMAL	ALBINO
Dark yellow	17	1
Yellow, grade 1	16	2
Yellow, grade 2	13	4
Yellow, grade 3	11	6
White	6	12
Total	63	25

Fortunately every seed germinated and it was immediately seen that there was a correlation between white or colorless endosperm and albino seedlings. The percentage of albino seedlings from the yellow seeds is 18.6, while the white seeds produced 61.5 per cent albinos. Had we been growing only the white seeds from this ear a very misleading conception of the ratio of albino to normal plants would have resulted. It is also

[2] COLLINS, G. N. *Hybrids of Zea ramosa and Zea tunicata.* Read at the meeting of American Naturalists, New York, December 29, 1916.

obvious that in a population of yellow and white seeds having an association between white endosperm and albinism the percentage of homozygous yellow plants would be greatly increased owing to the differential death rate between the yellow and white.

The five classes of seeds planted with the resulting seedling classes are shown in Table 1.

Arranged in the form of a fourfold table by combining the four grades of yellow the classes are as shown in Table 2.

TABLE 2

	NORMAL	ALBINO	TOTAL
Yellow	57	13	70
White	6	12	18
Total	63	25	88

The coefficient of association by Yule's method[3] is 0.795 ± 0.072 which is certainly too large to be ascribed to chance.

Using Pearson's formula[4] for the mean square contingency, $C_2 = 0.395 \pm 0.057$, which is a deviation above a zero correlation of 6.9 times the error. Although the number of individuals is small, the fact that the proportion of albino seedlings increased as the intensity of the endosperm color diminished may be of some significance. If it is assumed that the differences in shade between the four classes of yellow endosperm are due to separate factors, it would seem that these several factors are correlated with albinism, which on the linkage hypothesis would necessitate that these associated factors be located on the same chromosome.

As with many simple characters there are several degrees of albinism which grade from white to yellow by imperceptible stages. The present albino seedlings, while they were easily separated from the normal plants, varied among themselves from almost pure white to an appreciable amount of yellow.

[3] YULE, G. UDNY. *On the methods of measuring association between two attributes.* Journal Royal Statistical Society, **75**, Part VI, May, 1912.

[4] PEARSON and HERON. Biometrika, **9**: 167. 1913.

As the total number of albino seedlings was small no attempt was made to classify the degrees of albinism in relation to the degrees of endosperm color.

The inheritance of endosperm color has been studied by several investigators who have concluded that this character is composed of at least two factors. The results are not easily interpreted even with two factors, the investigations revealing many complications, and it is possible that these may be due at least in part to a linkage between the several factors for endosperm color.

The present correlation may be considered in the nature of a coherence since it is highly probable that the albino character and white endosperm were brought into this cross from the tunicate parent. The progeny of a self-pollinated ear from a sister plant of the male parent of the cross between *Zea ramosa* and *Zea tunicata* was noted in 1916 as having produced many albino plants. The yellow endosperm undoubtedly came from the ramosa parent and thus far no albino seedlings have been found in the strain of *Zea ramosa* we have been growing.

There is, however, the possibility that this apparent coherence is in reality a physiological correlation between white or albino endosperm and albino seedlings. As a demonstration of the truth or fallacy of this statement a strain having yellow endosperm, and producing gametes carrying the albino character should be crossed with a white strain lacking the albinistic tendency, but the final results of such a cross cannot be obtained before the fall of 1918.

ETHNOLOGY.—*An initiation at Hano in Hopiland, Arizona.* J. Walter Fewkes, Bureau of American Ethnology.

There are three pueblos on the East Mesa of the Hopi Indians called Walpi, Sitcomovi, and Hano. These villages, situated in Northeastern Arizona, are composite in population and have been affected in different degrees by influx of clans from different directions the former homes of these clans now indicated by ruins. The inhabitants of Walpi are homogeneous. Sitcomovi, originally settled by clans from Zuñi, has lost the Zuñi

idiom, but still retains a ritual which is essentially Cibolan (Zuñian). The latter pueblo is regarded by the Zuñi as one of their pueblos among the Hopi, its architectural features being those characteristic of Tewa pueblos on the Rio Grande. Architecturally Hano is also Tewan, and its inhabitants retain the Tewa idiom, its mythology and ritual being distinctly Tanoan, little modified by the neighboring Walpi.

The general character of the rituals in these three villages is known, but very little has been published on the ritual of the relatives of the Hano people who now live along the Rio Grande, especially as to the nature of the initiations of youths into societies of priests. The Hopi introduce personifications of ancestors in their pagan dances, and call the personators by the name, Katcinas (Cachenas), but apart from that our knowledge is fragmentary. At Hano this worship formerly survived in its original form, so that the following pages may give an idea of the initiation of boys and girls into the Katcina cult as once practised, possibly still persisting, in villages along the Rio Grande.

The month of February is an active one ceremonially in the calendar of the Hopi towns. It is the month when lustration rites are performed to purify the earth from the malign influences of a power which through sorcery is supposed to rule it in winter. In that month, the return of the Katcinas, led by their father, the Sun or Sky-god, is personated. The clans that came to the Hopi from the south personate the return of their Sky-god in December, the clans of Sitcomovi in January, but the Katcinas are supposed to return in February and to remain about the villages until July, when their departure is celebrated in an extended farewell festival. The February ceremony is called, in secular language, the Bean Planting, because beans are sprouted in the kivas to be symbolically used by the returning Sun-god to represent the fructifying forces of nature. These sprouted beans are given at that time to the heads of all the clans by the personator of the Sky-god, in answer to their prayers, as a symbolic promise of good crops during the year.

Of the various steps in initiatory rites from birth to maturity, in the life of pueblo children, none is regarded more important

than the last, or that in which they are taught the mysteries of the Katcinas. A child under thirteen or fourteen years of age is not supposed to understand the nature of these supernatural beings, but to believe that from time to time family ancestors or spirits of the dead revisit the pueblos and receive prayers for the good of the tribe, after which they return to ghostly homes in the underworld, through the house of the sun far to the west. At this age they are among other things made acquainted with the fact that the Katcinas are not real supernatural beings, but personations by their own parents. But they must obtain this knowledge through initiation, some of the ordeals of which may be regarded as severe and are certainly calculated to bring out the moral courage of the novitiates. Many rites occur, one of which is a ceremonial flogging of children, which takes place in the presence of chiefs and other persons of the tribe. The rite at Hano, the subject of this article, has never been described.

To understand the meaning of this event and the place the Katcina cult occupies in the pueblo mind, it may be well to say a word on this subject before we pass to the consideration of the initiatory episode. In all their cults Hopi ceremonies show many indications of the worship of divinized ancestors, but this is especially true in those of the Katcina worship. The spirit dead are supposed to become Katcinas. The breath bodies of men pass to their future home, the underworld, a realm of the departed, presided over by the supernatural being called the God of Germs. The population of this underworld includes not only the spirits of those long ago deceased, but also those who have lately joined them. This ghostly population is supposed to have a social organization like that inhabiting the upper world, being as on earth divided into clans with related priesthoods, in all the conditions of life duplicating what is found among the living. There are male and female Katcinas, brothers, sisters, uncles, aunts, and various other relatives on the mother's side. The clans of the underworld, after death, bear names of the living, and are symbolically characterized. We have for instance, the Bear clan, the Badger clan, and others. Prominent among all members of each underworld clan are the oldest members,

the ancestral parents of each clan, elevated to the cultus hero and heroine of the clan. The sun of course is father, and the earth, mother; they are common parents of all clans.

With this idea of the clan arrangement of the dead in the underworld let us consider their relation to the living clans, for this is the foundation of this cultus. Clan relationship not being severed by death, the deceased members are regarded as still members of the clan, with the same obligation to the clan as when alive on earth. What is most important of all is that the powers of these spirit ancestors are regarded as most efficacious in answering the prayers of the living. In other words, the clansmen of earth of the Bear clan feel that by addressing prayers to their relatives in the underworld, they, with their aid, can bring about what they desire. This can be accomplished by the use of magic or other supernatural agencies. The personation of ancient members of the clans are "conjured up" to hear the petitions of those of their clan, still living.[1]

The February ceremonial has for its primary purpose a celebration of the advent of these ancestral personages, while that in July celebrates their return to their homes in the underworld. The flogging of the young initiates, like other ritualistic episodes, contain many archaic survivals that have a foundation in an early myth recounting how the cult hero was initiated by the Sun father, in like manner.

The flogging ceremony at Hano, here described, took place in the larger of the two kivas, or sacred rooms, just before sunset on the 14th of February, 1900. This rite has been witnessed more than once, but the variations are slight, at most, and have no great significance.

As with all pueblo ceremonies some time is occupied with preparation of the paraphernalia used, as it has to be renovated for the special purpose. The walls of the room were replastered, and its floor thoroughly swept; all secular objects, as blankets in progress of weaving, were rolled up and put away, and smaller

[1] These returning clan members are represented by living members, who, for the time being, believe that they really become the members of the spirit branch of the clan which they represent.

objects tucked in certain niches made in the wall for that purpose. Boxes containing soil, in which bean seeds[2] had been planted a week before, were concealed by a wagon sheet hung across the end of the room.

Three personators took the prominent parts in the child flogging, two of whom personated the great Sky-god and the third represented the earth, or old woman, who they believe makes the germs of life grow. The personator who flogs the children represents the father of all living on earth as well as inhabitants of the underworld.[3] An account of his costume may be instructive as embodying their symbolic conception of these supernaturals.

Each personator of the Sky-god wears on his head a mask-helmet, painted black, and adorned with clusters of feathers, long beards made of horsehair with attached feathers hanging from their chins. The body, upper arms, and thighs are painted, smut from the bottom of an old cooking pot serving for black paint. Markings are drawn with gypsum on the upper arms and thighs, and the legs and forearms are painted with the same material. Several ears of corn strung together form their belts from which, reaching to their knees, hangs a fringe of horsehair stained red, the body being naked. This crude representation of the Sky-god has the same symbolic marks as a wooden idol of this god on a Hopi altar, and is called Tuñwup Katcina.

The three personators dressed near a shrine outside the kiva on the trail below the pueblo and entered Hano from the east in order to preserve the illusion that they came from a distant place in the east, where the sun, whom they personify, rises. They entered the kiva where spectators had already assembled, and shortly after their appearance, the man personating the Earth-woman entered the room passing through the hatchway

[2] These beans were forced to sprout in midwinter in a superheated atmosphere of the kiva, and were carried later by the Sun-god to represent symbolically fructification of food plants. Children were formerly taught that these sprouting beans are brought by a supernatural being, not being permitted to know that they were raised by their parents in the kiva.

[3] These men belonged to Hano clans. There are two Sky-gods in their mythology, one representing the sun, and the other the moon.

down the ladder bearing a flat basket with sacred meal to be used in the ceremonies.

It was about four o'clock, in the afternoon, when Anote, the village chief of the pueblo, Hano, entered the kiva, bearing in one hand two wands made of the leaves of the yucca or century plant, in the other hand his medicine bowl and a badge, indicating his standing as a chief. He placed this badge on the floor and deposited his medicine bowl near it. He then poured into the latter a white liquid, making passes in sequence with his hand towards the six cardinal points: north, west, south, east, above and below. He then stripped off the spines from the margins and points of the yucca leaves, scooped some of the medicine from the bowl into one hand and drew the leaves through it. Aided by another man he tied several leaves together making two whips, which were laid on the placque containing the prayer meal brought by the old woman.

By this time spectators had begun to assemble in the room, each one taking his seat on the raised floor at one end of the room. When they were seated, a number of adults, men and women, each accompanied by a child, who carried an ear of corn called "mother" in one hand, filed into the kiva and seated themselves along the sides of the room. When all were gathered the chief began to construct a rude altar on the floor of the room. He first made a low ridge of sand a few inches high into which he planted, upright, a row of 20 wing feathers. In front of these feathers he outlined on the floor, with meal, three semicircular figures, side by side, representing rainclouds, and added parallel lines of meal symbolic of falling rain. On the middle raincloud figure he set upright the badge of his office. A few feet in front of these figures near the firehole, he outlined with a line of meal a square figure crossed by two diagonals, on the junction of which, in the middle, he laid two small feathers. Having completed these preliminaries the chief took his seat back of the line of feathers and gave the signal that he was ready for the rite to begin. Shortly after, steps were heard on the kiva roof above followed by a voice hooting down the opening or hatchway, demanding permission to enter. The chief mounted the ladder

and spoke to those above. Immediately there followed him down the ladder the two personators of the Sky-god, and a man dressed as an old woman. These three made a circuit around the fire hole six times, after which the earth woman personator holding the basket of meal and whips, took position near the bottom of the ladder, and the two Sky-gods stood, one on each side of the rectangular meal figure on the kiva floor. The latter then began a rapid dance bending and swaying their bodies and shouting to the assembled spectators. Each was then handed one of the yucca whips, previously prepared as mentioned above, after which they resumed their dancing, calling out loudly for the children to come and be flogged. In a short time a woman led forward a girl about 11 years old, whose garment had been removed from her back, and placed her within the square outlined with meal. One of the Sky-gods immediately struck the bared back with the yucca wand several times, all the while continuing to dance and shout. He than passed to the other side exchanging places with his companion and the foster mother bared her back and was flogged as her child had been before her. The two Sky-gods again exchanged places, and whips, as yet unused, were given to them, after which a man, possibly a father, led a boy forward, both stepping inside the rectangle of meal. The boy was first flogged on the back in the same manner as the little girl, and the father was struck several times also on legs and arms. As each person entered the space occupied by the meal figure he took a pinch of meal and, raising it to his lips, threw it toward the Sky-god, uttering an inaudible prayer. The flogging continued until four children, and as many foster parents, or the men and women accompanying the children, had been treated in this way. Generally the punishment was received by the children without a flinch, but one of the girls was frightened. The Sky-god was lenient, simply whirling his whip over her head, without striking.

At the close of the flogging of initiates, other children, mostly boys, not initiates, voluntarily came forward and stood with backs bared for the whips. They were struck, oftentimes rather severely. Then adults, one after another, including the old

chiefs, stood up and were flogged, in the same way. As each person passed to the altar after receiving the blows he took a little liquid from the medicine bowl or meal from the basket, rubbed it on his wounds, without a word, and took his seat on the floor. The personators then left the room, after which the chief spoke at length, in Tewa idiom, to the assembled people. The author did not understand Tewa, but was told by an interpreter that he spoke to them on the meaning of the rite. He may have explained that it was a dramatization of an old legend and that the floggers were their own relatives personating supernatural beings. Following the speech the spectators then crowded around the altar, dipped their hands in the medicine, and took a handful of meal with which they rubbed their bodies, as both liquid and meal are considered salutary. At the close of the ceremony the children were led out of the room by their parents to their own homes.

On February 15, the day subsequent to that in which the flogging above described was performed, there was celebrated at Walpi one of the most unusual of all rites of the Bean-planting festival. The main events of this ceremony were prayers to a supernatural being called Masauu, the god of planting, also known as the supernatural of the "surface of the earth." The dramatic reception of Masauu occurred in a Walpi kiva at 8 o'clock in the evening and lasted far into the night. It is such an unusual event, having been witnessed by the author but once, that although it has no direct connection with the child-flogging it is introduced here, for want of a more appropriate place.

On the night when Masauu's visit was personated all fires throughout the East Mesa were extinguished. No one was met in the streets. Women and children were in hiding in back rooms, and darkened house terraces were deserted, for the dread being is greatly feared by all the Hopi. Knowing that he was to be personated that night, the author resorted to the chief kiva, in Walpi, early in the evening, and found about 20 men engaged in decorating their bodies with white kaoline paint, drawing lines down their backs and legs and placing

great daubs of white on their cheeks and hair. None of these men were masked, but all claimed they personated sisters or brothers of Masauu. Shortly after the author's entrance they began to sing their songs, containing strains of fine archaic Hopi Indian music, closely resembling in their cadences the song sung by the antelope priests in the well-known snake dance. While these songs were being sung a priest came down the kiva hatchway bearing two large hollow gourds, the surfaces of which had been painted black, and spattered with a wash containing glistening hematite. Each gourd was large enough to fit over the head and both were later worn as helmets by personators of Masauu. With these gourds the same priest brought two planting sticks of ancient form and two flat basket plaques which were laid with great reverence alongside the masks, near the fire hole. At the advent of this man all those present ceased their singing and lighted their pipes for a formal smoke, during which the pipes were passed around, every man silently puffing clouds of smoke upon the masks. No one of that gathering spoke a word but each fervently prayed in sequence, beginning with the chief, at the conclusion of which they again returned to their usual songs. During these songs one of the chiefs raised the painted gourd helmet and talked directly to it praying for success of crops during the coming season. The songs rose and became so loud that no one could tell what was said, but the intent throughout were prayers to fertilize the fields that the corn might germinate and grow. Shortly after, while the men were still singing and the light of the fire had been shielded from all eyes by a blanket, in order to darken the room, a naked man silently and unannounced came down the ladder, not as is usually the case backwards holding on the rungs, but as one would descend a pair of stairs. Entering the room without making the customary request, "Am I welcome here?" he slipped around back of the row of singers, peering anxiously at the masks on the floor. He finally came to the front from his hiding and squatted by the fireplace. Cautiously he placed the strange human skull-like gourd helmet over his head, threw a rough blanket around his

neck over his shoulders, and taking a planting stick in his hands assumed the kneeling posture which the Hopi take when they are planting on their farms, kneeling on one knee with the stick held vertically in his two hands. A second man who entered the kiva, in the same way donned the other helmet and without a word took his position near his predecessor. The songs of the assembled priests then became more animated and finally died down to a low murmur and ceased. The two personators manipulating their planting sticks in rhythm kept time to the songs. At the conclusion of which the singers filed out of the kiva, but as each man passed the fireplace he placed in the flat basket on the floor by the side of the kneeling figures a feather, symbolic of a prayer, for a successful harvest. As the last man left the room he halted for a moment at the fireplace, with one foot on the ladder rung and announced that in the spring, at planting time, a great ceremony to the planting god would occur in the fields to the west of Walpi. The prayers throughout this rite were particularly fervent, but so low they could not be heard even a few feet away. There was no loud talking and the faces of all were very serious as befitting the reverence for the beings addressed; many even went so far as to turn their faces away from the dread being to whom they prayed. After the departure of the men the two planting gods silently gathered up the feathered prayer offerings offered them, and departed.

The supernatural being called Masauu, also known as Eototo, was the chief cult being of the Fire people who migrated into the Hopi country, according to legends, from the East in prehistoric times. They formerly lived at a pueblo, now in ruins, three miles east of Walpi, called Sikyatki. A quarrel arose between Walpi and the inhabitants of Sikyatki, sometime before 1540, which eventually led to the overthrow of the latter pueblo, whose people were incorporated in the former. Their cultus supernatural, Masauu, transferred to the Hopi pantheon, is still from time to time personated by descendants of the ill-fated Sikyatki, now fused with other Walpi clans.

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. Each of the scientific bureaus in Washington has a representative authorized to forward such material to this journal and abstracts of official publications should be transmitted through the representative of the bureau in which they originate. The abstracts should conform in length and general style to those appearing in this issue.

GRAVITY.—*Investigations of gravity and isostasy.* WILLIAM BOWIE. U. S. Coast and Geodetic Survey, Special Publication No. 40. Pp. 196, with 18 illustrations. 1917.

For a number of years the U. S. Coast and Geodetic Survey has been carrying on geodetic investigations of isostasy with special reference to the effect of isostatic compensation upon the deflection from the vertical and upon the intensity of gravity. Four reports on these investigations have appeared previously. The first one was in 1909 and the last one in 1912.

The present report has as its main features: (1) The observed value of the intensity of gravity at the stations in the United States, Canada, India, and Europe, and at a few scattered stations. (2) Discussions of the relations between the gravity anomalies and the topography, the large areas of erosion and deposition, the geological formation as indicated by the surface rock, and the elevation of the station. (3) So-called regional versus the local distribution of the isostatic compensation. (4) The determination of a gravity equation and of the earth's flattening and the depth of compensation upon each of several assumptions. (5) Summaries of the results of the field observations with the pendulums, and descriptions of the gravity stations. (6) Illustrations, in the pocket at the back of the volume, showing graphically much data resulting from the investigation.

The results of the investigation may be summarized briefly as follows:

1. The most probable depth of compensation derived from gravity observations alone is 95 kilometers. As the author believes that the best value determined by Hayford from deflection data is 97 kilometers and that each of these two values should have equal weight, the resulting best value from all geodetic data is 96 kilometers.

2. In the United States there was found a decided relation between the sign of the gravity anomalies and the coast, but there was not found any apparent relation between the anomalies and any other class of topography.

3. In the United States there was found a decided relation between the gravity anomalies and the Pre-Cambrian geologic formation. In both the United States and in India there was found a decided relation between the gravity anomalies and the Cenozoic formation. No relation between the gravity anomalies and the geologic formations was found in Canada.

4. It was found from certain computations and investigations that the local distribution of compensation of the topographic feature is in general nearer the truth than regional distribution of the compensation out to a distance from the station of 167 kilometers. It was not proven whether local distribution is more probable than a regional distribution out to a distance of 59 kilometers from the station.

5. The best formula, resulting from this investigation, by which theoretical gravity may be computed for any latitude at sea level was based upon 348 stations; it is

$\gamma_0 = 978.039\ (1+ 0.005294\ \sin^2 \phi - 0.000007\ \sin^2 2\phi)$ in which γ_0 is the value of gravity sought and ϕ is the latitude of the station.

6. From the constants of the above gravity formula, was derived the value of 297.4 for the reciprocal of the flattening of the earth. This value of the flattening is very close to other values recently derived from gravity data in the United States and elsewhere.

7. The cause of the greater part of the anomalies is believed by the author to be in general the deviation from normal in the densities in the outer portion of the earth's material and probably not far below sea level.

The titles of a number of articles dealing with isostasy or related subjects are given. W. B.

PHYSICS.—*A specific gravity balance for gases.* J. D. EDWARDS. Bureau of Standards Technologic Paper No. 89. Pp. 20. 1917.

The need of an accurate method for determining gas densities has been especially urgent in the natural gas industry. To supply this need the apparatus described in this paper was designed. The balance is enclosed in a gas tight chamber and consists of a beam which is supported on 2 needle points, and which carries on one end a relatively large globe and on the other a small counterweight. The gas to be

studied is introduced into the balance case and its pressure is changed until the beam balances. The density is computed from the initial and the final pressures. The balance is standardized by similar observations made with the case filled with air. J. D. H.

CHEMISTRY.—*Experiments in the destruction of fly larvae in horse manure.* F. C. Cook, R. H. Hutchison, and F. M. Scales. U. S. Department of Agriculture Bulletins 118 and 245. 1914 and 1915.

Experiments during 1915 in the destruction of fly larvae in horse manure. F. C. Cook and R. H. Hutchison. U. S. Department of Agriculture Bulletin 408. 1916.

These three bulletins cover experiments extending over three years searching for satisfactory larvicides for fly larvae to be applied to fresh horse manure (the principal breeding place of the house fly) which would be without extremely toxic properties and without injurious action on the fertilizing value of the manure. The study involved entomological, bacteriological, and chemical investigations.

Over 50 substances have been tested of which three have been found effective and practicable. Some were excluded because of their extreme toxicity, such as potassium cyanide. The three that are recommended are borax, hellebore, and calcium cyanamid mixtures with acid phosphate.

Borax in large amounts injures plant growth, hence should be applied only to manure that is not to be used as a fertilizer.

Powdered hellebore (*Veratrum album* and *V. viride*) applied as a solution is an effective larvicide and, because it is decomposed in the course of the fermentation, does not affect the fertilizing value of the manure even when excessive quantities are used.

Calcium cyanamid mixed with acid phosphate and kainit are effective and, if enough acid phosphate has been added to give an acid reaction, the nitrogen and ammonia of the manure will be retained. The mixture is an advantage in that it adds to the manure nitrogen, potash, and phosphoric acid. F. C. C.

METALLOGRAPHY.—*The structure of the coating on tinned sheet copper in relation to a curious case of corrosion of this material.* Paul D. Merica. Bureau of Standards Technologic Paper No. 90. Pp. 18. 1917.

The attention of the author has been directed to a case of local corrosion, or pitting, in tinned sheet copper roofing. The pits occur in

general along the lines of surface scratches and are apparently unrelated to the service conditions, and to the direction of rolling of the sheet. They appeared some eight or ten years after the completion of the roof. The tin coating on copper consists of at least three layers; viz., a thin layer of Cu_3Sn immediately next to the copper, than a layer of Heycock and Neville's constituent H, containing about 60 per cent by weight of tin, and finally, a layer of the eutectic of tin and copper, in which most probably is found any lead that may have been present in the tinning mixture. The constituents of these intermediate alloy layers are more electronegative than either the tin or the copper. Consequently, when the copper becomes exposed, as at the bottom of scratches on the surface, it forms together with the alloy layer a galvanic couple, electrolytic action sets in, and the copper at these points is corroded, forming the pits mentioned. P. D. M.

GEOLOGY.—*Relations of the Embar and Chugwater formations in central Wyoming.* D. DALE CONDIT. U. S. Geological Survey Professional Paper 98–O. Pp. 263–270, with 3 plates and 2 figures. 1916.

The Embar formation of central Wyoming, which lies between the Tensleep sandstone and the Chugwater formation, comprises several distinct facies, each of which is considered in detail, and some of the formational boundaries in the Bighorn Mountain region are redefined. In connection with the description of the gypsum and associated strata it is suggested that possibly conditions were favorable for accumulation of salt beds also. The chance of finding such deposits down the dip below the surface is believed to be sufficient to merit further investigation. R. W. S.

BOTANY.—*Maxonia, a new genus of Tropical American ferns.* CARL CHRISTENSEN. Smithsonian Miscellaneous Collections, **66**[9]: 1–4. 1916.

The type and sole species of this new genus, *M. apiifolia*, is a rather rare polypodiaceous fern of Jamaica and Cuba, described by Swartz in 1801 under Dicksonia, and since variously referred to Dryopteris (or Nephrodium) and Polystichum. From Dryopteris, in which it was last placed as a special subgenus by Maxon in 1909, it differs in the unique morphology and development of the indusium, as also in its strongly dimorphic leaves and peculiar rope-like rhizome. The last two characters recall Polybotrya, between which genus and a small subgroup of Dryopteris species it is somewhat intermediate. A subspecies, *M. apiifolia dualis*, occurs in Guatemala. P. C. S.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

The 783rd meeting was held at the Cosmos Club, February 3, 1917. Vice President BURGESS in the chair; 61 persons present. The minutes of the 782nd meeting were read in abstract and approved.

A letter signed by several members of the society, calling attention to the recently organized American Metric Association, was read.

Mr. ARTHUR W. CLIME, introduced by Mr. ALEXANDER GRAHAM BELL, presented a communication on *Photoelectric radiophonic experiments.*

Mr. BELL, in introducing Mr. Clime, spoke of the history of selenium. He referred to the remarkable property possessed by crystalline selenium of having its electrical resistance affected by light; and of the utilization of that property in the construction of the photophone. He also referred to the discovery made by the late Prof. W. G. Adams, of King's College, England, that light produced an electromotive force in crystalline selenium. Mr. Bell had suggested to Mr. Clime that this opened up a new field for scientific investigation and recommended him to follow out the experiments of Prof. Adams by applying the results to radiophonic researches. He had also pointed out to Mr. Clime that the remarkable properties of carbon in radiophonic work would well bear exploration.

Mr. CLIME then exhibited some of the radiophonic apparatus he has constructed, and spoke of the results that had been obtained. He showed a selenium cell which, when exposed to an intermittent beam of light, caused a telephone connected with it to emit a musical sound even when there was no battery in the circuit. The result he claimed was due to an electromotive force produced in the crystalline selenium by the action of light. He also showed a cell in which the selenium had been replaced by lampblack. So long as there was a voltaic battery in the circuit the telephone responded well when the lampblack surface was illuminated by an interrupted beam of light, but he was unable to detect any audible effect when the battery was removed. A cell in which a mixture of selenium and lampblack was employed was then exhibited. In this case the sonorous responses of the telephone were very loud even when no battery was used. The musical tone was clearly perceived when the telephone was held at a distance of several inches from the ear. On account of the magnitude of the sound produced by the selenium-carbon mixture, Mr. Clime predicted the possibility of producing, by the action of sunlight, an electromotive force of sufficient power to be of economic value.

Discussion. The paper was discussed by Messrs. ABBOT, BAUER, and WEED. Mr. SOSMAN inquired as to the nature of the effect of adding carbon. Mr. Clime stated that the increase in response seemed out of all proportion to the increase in absorption due to blackening the surface. Mr. BRIGGS asked about a lack of symmetry in the illuminated system, and Mr. SWANN spoke of observing small electromotive forces in very thin films of platinum illuminated by a beam of light not perpendicular to the surface. The chair expressed the thanks of the society to Mr. Clime for his interesting communication.

Mr. W. W. COBLENTZ then gave a paper on *Characteristics and comparative sensitiveness of various types of radiometers.*

The various types of radiometers were divided into three groups.

Group I includes radiometers which are nonselective in their response to stimuli of radiant energy of all wave lengths. In these instruments the radiant energy is absorbed and converted into heat. They include the Nichols radiometer, the thermocouple, the Boys radiomicrometer, and the Langley bolometer. In all these instruments the response is proportional to the stimulus, and they are well adapted for quantitative work.

Group II includes substances which have the property of decreasing in electrical resistance when exposed to radiant energy of short wavelengths, especially visible and ultraviolet rays. The phenomenon depends entirely upon the wave-length of the light stimulus. Many substances are "light-sensitive," e.g., copper oxide, sulphides of antimony and silver, and crystalline selenium. The latter has been the most extensively investigated. Its sensitivity depends upon heat treatment, and varies with the intensity and wave-length of the light stimulus. After exposure to light for a few seconds, it requires a long time to recover its normal ("dark") resistance. It is not adapted to quantitative work.

Group III includes the photo-electric cells, substances which, when charged to a negative potential, lose their charge when exposed to light; especially violet and ultra-violet rays. This emission of electrons is a surface phenomenon, easily disturbed by oxidation of the surface. The photo-electric cells investigated consisted of potassium and rubidium. It was found that the response (galvanometer deflection) was not proportional to the intensity of the stimulus, but, differing from the selenium cell, this lack of proportionality of response does not appear to depend upon the wave-length of the exciting light. In 1907 Angström described a new method for studying solar radiation. By covering his pyrheliometer with a blue glass he was able to study atmospheric diffusion of solar radiation independently of the water vapor present. He obtained some very interesting data on the temporary variations in the solar constant. In view of the fact that the potassium photoelectric cell has its maximum sensitivity in the violet, the speaker tried it as a pyrheliometer. It was found entirely too sensitive (on only 2 volts) to be used with an insensitive d'Arsonnal galvanometer. Using a higher voltage and a milliammeter, the

current released when the cell was exposed (through blue glass to reduce the intensity of the sun-light) was sufficient to overheat the wires and crack the glass cell. This investigation should be continued, using a less sensitive photoelectric substance.

In certain spectral regions the sensitivity of the selective-radiometers is far greater than that of the non-selective instruments. The sensitivity of the selective instruments seems spread in the non-selective radiometer over the whole spectrum, with a corresponding reduction to a uniform and much lower value. From published data it appears that a single crystal of selenium, 1 sq. mm. in area, is 100 times as sensitive as the best selenium cell. In connection with a 36 inch telescope such a crystal receiver could detect a candle at a distance of 350 miles. The photoelectric cell is probably even more sensitive than the selenium cell. However, these instruments are very insensitive in comparison with the eye, which responds to light having an intensity of less than 1×10^{-9} ergs.

Discussion. Mr. ABBOT spoke of some radiometers of very high sensitivity in which the alignment of small magnetic needles was changed by the thermal expansion of the parts holding them. Mr. SWANN spoke of obtaining readings by placing a Peltier junction beside a thermocouple and maintaining the thermocouple at a constant temperature by the Peltier effect. Mr. ABBOT spoke of increasing the sensitivity by cooling the apparatus in liquid air. Mr. COBLENTZ stated that temperature differences in the surroundings make it very difficult to get consistent results.

DONALD H. SWEET, *Secretary.*

THE BIOLOGICAL SOCIETY OF WASHINGTON

The 564th meeting of the Society was held in the Assembly Hall of the Cosmos Club, Saturday, January 27, 1917; called to order at 8 p.m. by President HAY; 45 persons present.

Under the heading of brief notes, Messrs. W. L. MCATEE and A. WETMORE made remarks on certain misconceptions as to the notes of some common species of birds and as to a theory of the migration of birds.

Under the heading exhibition of specimens, DR. O. P. HAY showed a metacarpal of a horse with well developed lateral metacarpals, and three fused metacarpals of a cow each with well developed digits.

DR. L. O. HOWARD commented on an enthusiastic antimosquito convention which he had lately attended in New Jersey.

The regular program consisted of two communications:

H. M. SMITH: *Exploitation of neglected aquatic resources.* Dr. Smith called attention to many forms of fishes not used as food by the American public, but which are of pleasing taste and of good food value. Many of these have long been used for food by Europeans especially about the North Sea. He gave a brief résumé of the discovery, disappearance, and rediscovery of the tilefish and of its successful introduc-

tion to the consumer through exploitation by the Bureau of Fisheries. He then described the dogfish and its habits destructive to other fish and the losses caused by it to fishermen. He told of the efforts now being made by the Bureau of Fisheries to market the dogfish as a food. Under the name of grayfish it is now being successfully canned and marketed by some of the New England fisheries and, during the winter months when salmon are unattainable, by some of the salmon canneries on the Pacific coast. The canned meat not only constitutes one of the cheapest forms of protein now available, but the livers of the dog-fish yield a valuable oil; the oviducts, eggs; and the skin a leather which has many possibilities. Discussion by Messrs. AMES, BEAN, and DOOLITTLE.

W. L. MCATEE: *Showers of organic matter.* Under this heading Mr. McAtee gave a review of the various apocryphal and authentic instances in which hay, grain, various insects, encysted animalcules, worms, frogs, toads, fishes, and birds had fallen from the sky. The explanation was offered that the objects had been carried aloft by violent currents of air.

The 565th meeting of the Society was held in the Assembly Hall of the Cosmos Club, Saturday, February 10, 1917; called to order at 8 p.m. by President HAY; 30 persons present.

Two formal communications were presented:

H. F. TAYLOR: *A mortality of fishes on the west coast of Florida.* During the months of October and November, 1916, by some obscure cause, vast numbers of fishes were killed in the region mentioned. It appears to be a recurrence of the phenomenon observed in 1844, 1854, 1878, 1880, 1882, 1883 and 1908. Of the dead fishes 63 species, representing 37 families, were identified. The animals killed were confined, with the exception of king crabs, sea urchins, and sponges, to the class *Pisces*. Various suggested causes were examined; foul Everglade water, diseases, and volcanic eruptions are inadequate explanations. Evidence at hand seems rather to show that the cause of mortality was the release of occluded bottom gases by small seismic disturbances, or possibly by abnormally large numbers of *Peridinii*. Mr. Taylor's paper was illustrated by lantern slide views of the region involved and of strips of shore showing the large numbers of stricken fishes. His paper was discussed by Messrs. HAY, BARTSCH, GOLDMAN, RADCLIFFE, and others.

PAUL BARTSCH: *Changes in the avifauna about Burlington, Iowa, 1885 to 1917.* From 1885 to 1893 Dr. Bartsch was resident of Burlington and an enthusiastic bird collector. In the ideal conditions found for birds at Burlington he had recorded 275 species. Since 1893 he has been a sporadic visitor to Burlington but has always retained his interest in the local avifauna. Passenger pigeons, Carolina parakeets, whooping and sandhill cranes, and trumpeter swans were found about Burlington, but are no longer seen. The same is true of the Mississippi kite, the swallow-tailed kite, wild turkey, and

prairie chickens, the latter in times past having been shot from the speaker's porch. The prothonotary warbler, once common, appears to have gone northward. New birds now found at Burlington have come from the west, such as western meadowlark and red-shafted flicker. Other newcomers are the tufted tit and Carolina wren. Many of these changes are due to human agencies, some are unexplainable. Dr. Bartsch's paper was discussed by Messrs. HAY, MCATEE, WILCOX, GOLDMAN, JACKSON, and others.

M. W. LYON, JR., *Recording Secretary.*

THE BOTANICAL SOCIETY OF WASHINGTON

The 117th regular meeting of the Society was held in the Assembly Hall of the Cosmos Club at 8 p.m., January 2, 1917, President T. H. KEARNEY presiding. Mr. C. W. WARBURTON was elected to membership.

Under Brief Notes and Reviews of Literature, Mr. W. T. SWINGLE called attention to a recent trip by Prof. E. D. Merrill of the Philippine Bureau of Science, to the vicinity of Canton, China, where 3000 botanical specimens were secured.

The regular program was devoted to the subject of Plant Introduction under which the following papers were presented:

The need of more foreign agricultural exploration. (Illustrated): DAVID FAIRCHILD. Attention was called to the need of more foreign agricultural exploration and to the fact that only a comparatively small amount of money had been expended in such work. The amount had seldom, if ever, exceeded $18,000 in any one year, and for the most part the expense had been much lower. The most successful type of agricultural exploration has been carried on by men who are interested in particular lines of agricultural work. Among those who have been called into the exploration work temporarily are Messrs. Kearney, Carleton, Hansen, Swingle, Cook, Collins, Oliver, Aaronsohn, Meyer, Rolfs, Bessey, Knapp, Mason, Scofield, Shamel, Dorsett, Popenoe, Young, Lake, Bolley, Shear, Tracy, and Fairchild. Attention was also called to the need of studying the methods of agricultural production in foreign countries, to some of the more important recent introductions, and to the difficulty in getting people to adopt new foods.

The wild relatives of our crop plants; their value in breeding; how to secure them. (Illustrated): WALTER T. SWINGLE. The importance of the wild relatives of our cultivated plants in effective breeding for such desirable qualities as hardiness, earliness or lateness of blooming or of ripening, disease resistance, extra vigor, etc. was discussed. Frequently these wild relatives were found to be inconspicuous plants quite unlike the cultivated forms in appearance and were often native in remote localities. The Australian desert Kumquat, *Eremocitrus glauca*, for example, was originally described under the genus *Triphasia* and afterwards transferred to the genus *Atalantia*. In neither of these

genera was it properly placed, since it is closely related to true citrous fruits and will hybridize with the cultivated forms. Not cursory inspection of botanical literature, but protracted critical study of the botanical relationships, was necessary to make plain the desirability of the introduction of this species for the successful breeding of hardy and drouth-resistant citrous fruits. Plants not so closely related to the cultivated forms have been found useful stocks upon which to graft cultivated varieties. A properly digested taxonomic knowledge of the wild relatives of our cultivated plants was found to be indispensable as a foundation for all efficient plant introduction and plant breeding.

The introduction of foreign plant diseases: R. KENT BEATTIE. American agriculture has been based largely on introduced plants. Only twelve of the two hundred and forty-seven species of cultivated plants studied by De Candolle in his *Origin of Cultivated Plants* are clearly indigenous to the United States. Diseases of American economic plants may be separated into two groups: (1) Those which have passed from native plants to the introduced hosts, such as pear blight; (2) Those which have been introduced, such as citrous canker and the chestnut bark disease. Plant disease may be introduced in three ways: (1) The diseased crop plant may be imported for commercial use; (2) The diseased crop plant may be imported for scientific purposes; (3) The spores of the disease-producing organism may be brought in on plants not affected by the disease.

Commercial plant introduction, except field crops and florist stock, has been under a system of permit and inspection. In most states, however, the inspectors were trained as entomologists rather than pathologists, and there has been little restriction on the commercial importation of fungus plant diseases, except in the case of specifically quarantined crops. Material imported by the U. S. Department of Agriculture has undergone rigid inspection and plants which show symptoms of disease or arouse suspicion have been treated or grown under restraint until danger was passed. During the year 1916 the Pathological Inpectors of the Federal Horticultural Board while examining the material imported by the U. S. Department of Agriculture found one hundred and sixty-three hosts affected with disease and determined one hundred and fifty-seven diseases on these hosts.

The protection and propagation of plant introductions: B. T. GALLOWAY. The rapid change in public sentiment in the matter of plant sanitation and plant hygiene and the need for a constructive policy in the matter of adequately protecting our crop plants, and at the same time not closing the doors to the development of new crop industries through the introduction of plant immigrants, was discussed.

The Office of Foreign Seed and Plant Introduction in the Department of Agriculture has received seeds and plants from all over the world. These seeds and plants were grown, propagated, and tested at four outlying stations. It has also acted as the agent for handling seeds and plants from foreign countries for other branches of the Department, for the experiment stations, and for many private and pro-

fessional experimenters throughout the country. It has recognized the dangers to our important crop industries and has endeavored to take such steps as, in the light of our present knowledge, will insure that nothing but plants free from parasitic enemies and transmissible diseases are distributed.

The practical questions now confronting the office are as follows: (1) The organization, development, and equipment of a central plant and seed receiving station where plant introductions and plant materials of all kinds may be received, inspected, treated, and held if necessary, under conditions that will safeguard the country, and at the same time not prove to be a bar to a safe and constructive development of new plant industries; (2) The discovery and application of methods of treating seeds and plants, cuttings, buds, bulbs, etc., in such fashion as will free them from parasitic enemies and transmissible diseases, and at the same time not injure them or completely destroy them; (3) The discovery and application of improved methods of reproducing plants by seeds and vegetative parts in such manner that they will be free from parasitic enemies and transmissible diseases; (4) The conducting of field tests and trials for the purpose of determining the healthfulness of new or promising plant immigrants, and their suitability for general distribution; (5) The great need of further knowledge of plant propagation and plant and soil sterilization in order to provide methods which are less empirical than those in use at the present time.

H. L. SHANTZ, *Corresponding Secretary.*

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON

The 506th meeting of the Society was held in the Lecture Hall of the Public Library, Tuesday evening, February 6, 1917, at 8 o'clock.

Dr. J. WALTER FEWKES, of the Bureau of American Ethnology, read a paper on *Prehistoric ruins of the Mesa Verde National Park.* This communication was mainly taken up by an outline of the work accomplished by him, in the summer of 1916, under direction of the Bureau of American Ethnology, at the request of the Department of the Interior. After a brief introduction on the situation and physical features of the Park and a short account of archeological work already accomplished, the speaker described in detail the uncovering and repair of one of the large pueblo-like buildings of the Mummy Lake group, situated on the Government road, 4½ miles from the ruin known as Spruce-tree House.

The mound excavated is one of the largest of the group, and when the work began gave no indication of the form, size, and architectural features of the building it covered. After three months' work there was brought to light a rectangular structure, 113 feet long by 100 feet wide, three stories high, with an enclosed court on the south side. The ground plan showed the existence of four circular, ceremonial rooms compactly embedded in fifty rectangular enclosures which were for-

merly used for secular purposes. The remarkable feature of this ruin is the large size of one of the circular rooms, situated in the center of a compact group of chambers. From the wide southerly outlook this ruin has received the name, Far View House. It is a pueblo habitation; the first of its type ever brought to light on the plateau. The ruin was repaired, the tops of the kivas being treated with Portland cement to protect them from the elements.

After describing the various architectural details of the building Dr. Fewkes passed to a consideration of what he termed the morphology of the structure, or the comparison of it with other types, especially the cliff dwellings of the Mesa Verde. He declared that it is a new type of ruin for that region, and that there are evidences of many other examples of the same general character now indicated by mounds; we may say that formerly there were as many members of this type on the Park as cliff dwellings in the caves of the canyons. He considered in detail some of the arguments bearing on the relative age of buildings like Far View House, and the cliff dwellings, and came to the conclusion that the former were the more recent, and evolved from the habitations in cliffs.

Considerable time was devoted to a discussion and comparison of the so-called kiva or sacred room. He held that this chamber should be made the basis of classification of pueblo ruins, and that it was represented by the tower found widely distributed in Utah and adjacent regions of Colorado. He pointed out the wide-spread custom of dual styles of buildings among primitive races, one type being devoted to religious purposes, the other to habitations. He claimed that the former are always better constructed than the latter. He regarded the tower as a religious building and thought that the people who used it lived in dugouts or temporary habitations that have disappeared. In the earliest times these two types were separated, but in later stages in the evolution of buildings they became united, and habitations were constructed around the bases of the towers. Later in the course of development the central original building lost its tower-like form and became the circular kiva. Several similar architectural units, by union, formed a pueblo.

Dr. Fewkes pointed out that the great morphological similarity between Far View House and the pueblos with central kivas and towers, many miles away, had an important bearing on the distribution or diffusion of pueblo culture. He regarded the San Juan region as the nucleus from which the pueblos south and west originated, thus substantiating by archaeological evidence the legendary traditions of the inhabited and much modified historic pueblos. He claimed that there were two nuclei of distribution of house builders in the southwest, each arising in regions physiographically and climatically distinct, each possessed of different materials available for architectural advancement. One arose in the Gila Valley, the other in the San Juan; the former spread toward the north, the latter to the south. Both nuclei were extinct before the historic epoch. What remained, or

that which we now know as the culture of living descendants, is the product of acculturation, due to cultural contacts in this expansion. History can afford, therefore, only an imperfect picture. We must rely on archeology, mainly architectural, and ceramic remains, supplemented by ethnology, to discover the nature of the culture of these two original nuclei.

In a discussion of their distribution the speaker showed numerous illustrations of the prehistoric kivas, called towers, situtated in Hill Canyon, near Ouray, Utah. To these he gave the name, suggested by their site, Mushroom Rock ruins. Their more striking peculiarity is their position on the tops of inverted cones, or mushroom-like formations of rock, produced by the enormous erosion evident in the region where they occur. He said that this form of ruins was not morphologically a different type from towers, but their site was so unusual that it was convenient to designate them by this name.

While the important question of the antiquity of the cliff dwellings has not been satisfactorily answered by the observation made at Far View House, progress is being made in the accumulation of significant data bearing upon it. As long as this question remains unanswered the archeologist has plenty of research before him for many more years of field work in the Southwest.

The communication was illustrated with lantern slides.

The 507th meeting of the Society was held in room 44 of the New National Museum, February 20 at 4 p.m. The speaker of the afternoon was Dr. I. M. CASANOWICZ of the New National Museum, who presented a paper on *The fish in cult, myth, and symbol.*

Dr. CASANOWICZ said, "The fish, as the inhabitant of the mysterious, indestructible, never-resting water, early impressed man deeply, and was considered by him as the genius and representative of the life-producing element. Traces of the veneration of the fish, sometimes revealed in taboos, are found everywhere in ancient times and still exist in various parts of the world." An important center of ichthyolatry in antiquity, according to the testimony of classical writers, was Syria where a fish goddess under the name of Derketo-Atargatis was worshiped as a phase of the great Semitic mother goddess Astarte, being regarded as a personification of the fructifying power of the water. Reminiscences of this cult still survive in the cherishing of sacred inviolate fishes in some places near mosques.

Tales of the fish as a medium of transformation and incarnation of spirits and ghosts are met with among various nations, and in later times the fish seems to have been, next to the bird, a symbol of the departed human soul. The fish as carrier of man across the water was illustrated by the story of Arion and the dolphin as told by Herodotus, and by the Biblical narrative contained in the book of Jonah. Parallel narratives of a man being swallowed by a sea monster were quoted from Greek, Polynesian, and Cherokee lore.

The belief in the magical and apotropaic properties of the fish was

also found to be widespread. The fish was generally considered as a being of good omen, benevolent and beneficient toward man, and by reason of its own great fertility it was a symbol of increase and abundance. Various regions had their favorite species of fish which were endowed with supernatural qualities. Thus among the classical nations the dolphin was termed the "saviour fish" (piscis salvator). In the Far East (China and Japan) the carp was the fish of good omen, while among the ancient Irish the salmon was the "fish of wisdom," the mere sight of which brought healing.

Dr. SWANTON introduced the discussion of the paper by calling attention to the fact that migrations of Indians were influenced largely by the food supply. Thus many tribes of Indians followed the rivers and streams because of the presence of fish. Dr. MICHELSON mentioned the legend of a miraculous fish among the Delaware Indians, and also noted a similarity between the ancient beliefs concerning the fish and those held by the North American Indians. Mr. E. T. WILLIAMS spoke on the use of the fish in Japan and China, the latter country considering it martial in character because of its fearlessness in proceeding against the current of a stream, and also because of its scales, which suggest a coat of mail.

FRANCES DENSMORE, *Secretary.*